

1. Engaging students in environmental health research and outreach: The Science of a Healthy Home

2. Contact details

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3. Brief Description

Students developed and evaluated an environmental health outreach program about the critical role of indoor home environments on early childhood health in a rural, low-income community. The course leader provided the causes of childhood diseases and health disparities, the class then evaluated effective and ineffective health campaigns. Using this academic foundation, the class planned and implemented an outreach effort, then assessed its efficacy in reaching and educating its target audiences.

4. Context

Programme: The Environmental Science Department offers a BA in environmental studies and a BSc in environmental science.

Course / Unit / Module Title: ES 588: Junior Seminar in Environmental Health, Justice and Development

Level: At Allegheny College, the junior seminar is a required one-semester course, in the third year of a four year course that provides a window into the research experience and which allows students to develop a thesis proposal. This course prepares students for their thesis project. All students at Allegheny are required to conduct an independent one or two semester thesis project, which allows the student to conduct original research, evaluate it and place it in context with existing professional research. In the interdisciplinary Department of Environmental Science (ES), the junior seminar is taken in the third year, so the students have some cross-disciplinary training, and some early experience into project-based learning. Each junior seminar, which typically has between 8 and 24 students, has a different theme, geared to the faculty and students interests. For example, the ES department has sponsored junior seminars on green building on campus, wetland ecology, local foods, and endocrine disruptors. The structure and nature of the course can vary dramatically between seminars within the same department.

5. What does the student and the teacher / instructor do?

Teaching research is hard. "Teaching by doing," which allows students to get their hands wet while learning the process of research, often yields students with a strong understanding of some select aspects of the research process, but it can involve an extraordinary investment on the faculty to develop relevant and targeted research components. New faculty, faculty in academic settings with high teaching and research obligations, and anyone else whose

schedule feels too compressed may view the introduction of a hands-on research experience into an undergraduate classroom as too onerous in comparison to hosting a graduate-style seminar. However, there are many ways to streamline the process to ensure that students are getting a more hands-on approach while also protecting faculty time investments. This case study discusses a specific class taught in the fall of 2007 at Allegheny College and is annotated to provide guidance for other faculty hoping to strengthen the research components of their own undergraduate courses.

I am a faculty in Environmental Science, an autonomous interdisciplinary department with two undergraduate majors (Environmental Science and Environmental Studies) at a small liberal arts college in northwest Pennsylvania. My focus is environmental health, and I bring some aspects of my research into every course that I teach. In the fall of 2007, I taught a junior seminar for both our studies and sciences majors, ES 588 Environmental Health and Community Development. This course has a great deal of latitude in its subject matter, but it must help students to develop a solid proposal for their year-long senior thesis project and provide the opportunity to them to expand their understanding in the research process, from identification of a research question, to the development of a methodological approach, to data gathering and evaluation. This class does not have to be taught using a hands-on approach, but I believe there is no more effective strategy to reach these class goals. The real trick is doing so without overextending yourself.

My research area addresses the health implications for children from the indoor home environment. I run a program called, "Healthy Homes-Healthy Children," and we conduct free household assessments that provide environmental monitoring (such as lead, mold, radon), partner with medical professionals in the region to offer free screening and preventive well-visits for children, and provide outreach to the community, focusing on both targeted audiences, such as social service agencies, medical professionals, and early child education leaders, and also on the general public through community events. I knew that I wanted to incorporate some aspect of my research into the class, but was reluctant to bring my students along on "real" home assessments and did not have lab time to involve students in tests to examine methodological issues related to the home assessments. I did not yet have enough data or the confidence to train them appropriately to evaluate medically-sensitive data gathered under confidentiality clauses in conjunction with a local pediatrics practice.

I decided that some aspect of the outreach effort could provide enough material for the students to work with, while protecting myself and my community partners from possible gaffes if the project was unsuccessful. During the summer of 2007, I began to conduct outreach efforts to educate communities about the things that families can do to improve their children's health and to enroll participants. I quickly realized that there are many possible ways to evaluate outreach efforts, and yet there has been very little published literature that truly measured the impacts and successes of various efforts. This seemed like an ideal project to use for the foundation of this course. I decided to leave the specifics of the actual project to the students during facilitated class sessions.

For the first few weeks of class, I provided an overview of the topic—children spend nearly 80% of their time indoors, and especially in the early years, anything to which they are exposed can adversely impact their development. We then spent a good deal of time evaluating effective and ineffective public health campaigns, ranging from well known anti-smoking campaigns to the more targeted campaigns against specific health risks such as mosquito borne diseases (both domestic and international), sexually transmitted diseases, and the use of seatbelts. Many of the examples were outside the field of environmental health, but the strategies were applicable. This is an area in which I am not an expert, but which is a well-developed field that has a number of good resources that I was able to share with my students.

During this time, we began to brainstorm ways in which our class could conduct and evaluate an outreach campaign. The goal of the outreach was to develop more educated citizenship about health concerns to children from the home environment. About one-third of the way through the class, we decided to compare the efficacy of outreach directly targeted to students in 5th and 6th grade (10-12 years of age) to outreach targeted more broadly through family-oriented community events, such as a children's workshops and a Halloween parade. This particular age group was selected because of the ability for children at this age to understand some of the complexity of synergistic effects and exposures on health. The class also hoped that the children could act as a proxy for the head of household and could help to educate the family, but we were not able to test this theory.

The students made contact with two local school districts and arranged visits to eight classes at four schools, and five community events. They were interested in expanding the outreach materials that I had already created with students during the summer and they had to develop assessment tools to determine the program efficacy. They also had to complete the IRB proposal (Institutional Review Board) for the protection of human subjects. Quantitative survey data, addressing how well participants learned and retained information about Healthy Homes, were tabulated and analyzed, as were qualitative assessments from community partners. Additional measures of impact were evaluated as well, including the number of home assessments that were generated from both types of outreach.

Students presented their findings in a public meeting to community partners, teachers, school district administrators, local public health officials, campus administrators and ES department faculty and students. Using feedback from the presentation, they completed the semester with a single written document with report overview, background, findings and recommendations.

Students provided self-evaluations and group evaluations for this project, which as a whole comprised a significant part of their grade. However, their individual progress and thesis proposal, as well as engagement in the class and in the smaller assignments, also contributed to the final grade.

6. Hot tips and things to look out for

I chose the topic as much by what I was NOT willing to do as what I wanted to accomplish:

- What would NOT ruin my hard-won professional relationships with my community partners?
- What would NOT put myself or the research project at risk of jeopardizing participant confidentiality on existing projects?
- What would benefit my own research? (I decided that the project did not necessarily have to be a primary area within my own research, but should tangentially have some value. In this case, a great deal of the work in this field of environmental health outreach is not conducted by academics but rather by public agencies and non-profit organizations, so rigorous evaluation does not exist. This field therefore appeared to be a rich one for students to enter.)

Student outcomes (the final product) did not need to be perfect or directly publishable in order to provide the students with an exceptional learning experience or to provide me with useful information that I can use in my research. Pilot studies such as these can often seed new areas of research, or help the researcher identify major barriers that can arise.

The students gain tremendously in conducting a project that has real value to the community and to the researcher. Students have a real desire to make an impact. To this end, I

recommend having real community stakeholders involved in your project, even if the project does not have as explicit a focus on the community.

Some hand-selection is essential (e.g., getting a super reliable responsible student to coordinate community contacts will make the difference between a successful community partnership and one that leaves the community with the hope to never interact with students again!) While I give the appearance that students are making the decisions entirely on their own, I actually guide them subtly in many ways. I want the project to succeed to the highest degree it can—this will after all benefit me as well. However, there is a fine line between guiding and directing. At some point, it is beneficial to let the students learn along the way.

For community-based projects, I always take advice that was shared with me by a colleague—under-promise what the students can accomplish, so that any successes will be viewed positively by the community, and simultaneously tell the students that this is an incredible opportunity and set high expectations. Although I have strong community partners and contacts, most of the contacts in this project were ones that we developed along the way, so I was wary of major blunders, since we had not established the mutual trust that can allow for occasional gaffes. Typically with this type of preparation, the students will outperform your expectations, and will provide an end product that you can be proud of, even if it is not yet ready for public peer review.

Finally, students benefit tremendously from topics in which you are really excited, and at least moderately knowledgeable. However, you don't need to be an expert. In fact, this is really a perfect way to engage students in new research—the ability for them to learn along side you as you explore an unknown question is really what we are trying to convey. The excitement you convey for the topic and discovering the answers to the unknown will engage students in the process of research itself.

7. Does it work?

There are various measures of success. Most telling, the students in the class enjoyed the program so well that they collectively requested to continue it through independent study, volunteer or outside class projects through the spring semester 2008 and beyond. They recruited half as many new students as they had already involved, and were able to develop an ongoing program, the Healthy Homes-Healthy Children Educational Outreach Team, to continue this work.

From the students' learning perspective, they gained an extraordinary amount (Fig 1). Perhaps more telling, I reviewed some of the best thesis proposals I had ever seen from this class. That is not to say that the students will follow through with these projects—they still had nearly a year before they initiated their research; however, their grasp of some of the fundamental research challenges—topic, hypothesis development, scale and scope, methodology—were sharply honed for a group of third year students.

Another measure of success was the perceived value by the community partners. The school teachers (and their students) each learned a great deal and asked if we would be willing to return in future years. They recognized the value of having college students as role models in their classes, and they actively assisted in guiding the developing program. One set of administrators from one of the school districts was so enthusiastic that he has helped the Outreach Team prepare a proposal to develop additional materials that align with curricular standards that would allow the teachers to use this topic as a longer module.

Regional health agencies and partners who hosted the community events were both engaged—the medical professionals were excited to see some of the key issues of concern in this lower-income rural region receive attention and preventive materials being promoted to the community. The event partners were happy to see interactive but educational materials shared during their events, which lends credibility for their own funding agencies.

From my perspective, this outreach pilot effort refocused part of my own research directions, and based on the preliminary findings, I am including additional outreach evaluation in my upcoming grants to support the Healthy Homes-Healthy Children program.

8. What problems / issues have arisen?

The project as a whole is challenging to undertake, as I wanted it to fill multiple roles: provide an engaging topic, be the proper scale and scope, benefit the community, provide a legitimate research experience for my students—not just an opportunity to do a service project, and address a need within my research agenda. Based on past projects, I recommend picking projects that seem too small and if needed spending additional time placing them in context. This is always preferable to having a project that vastly exceeds the time allotted in a course, which doesn't provide students the time to synthesize their findings, present them to the community, or really internalize what they have experienced. As with many aspects of learning, students need the self-reflection to understand what they have learned, so the additional time is essential. For projects that are cutting close to the edge of the semester, it may be valuable to try to evaluate success over time—make sure to stay in touch with students a semester, year or more after the project ended, when they will have had additional time and maturity to understand and internalize some of the skills that they gained. For many classes, faculty may want to be able to “see” early evidence of progress in the event that the class doesn't reach the last steps.

Another significant challenge for students is not knowing what to do during parts of the class. Research is rarely clear cut, and when students are asked to conduct research, there will certainly be times when there is no clear path. Consequently, it takes more than a faculty's passion for the topic or for undergraduate research to make this type of class successful. The faculty must guide students through stages of the research process that are uncomfortable for novices, often difficult to explain in advance and have the potential but not guarantee of a clear outcome. Prepare students in advance by telling them at the beginning of the semester that research entails confusion, and that they should expect to encounter some segments of the research process when they are feeling anxious about the outcome and unclear how to proceed. When the students arrive at this point in the process during the semester, remind them that this confusion is part of all research and that it was expected to happen, just as you discussed at the project outset. Texts—even those that walk through the research process—aren't typically enough to allay student anxiety during these times, but good ones might help to some degree.

Students in ES588 experienced some of these frustrations, even with some of the preparatory discussion on the nature of conducting research and how there are times when there is less clarity (Fig 1). In particular, students often have difficulty with several areas that are perceived poorly when compared to other more traditional courses (such as class organization), which is inherent in the structure of research. Having not had a class that forces them to conduct research in the past, students will recognize that a hands-on approach to research in a classroom is messier than other typical classes. However, many students want to equate “messier” with “lower quality,” or “less value.” The faculty must help them to understand this distinction both to improve the student learning and to prevent unnecessarily low student evaluations.

Finally, coordinating with a community is always hard and time-consuming. Students are accustomed to operating through text messaging and email. Community members are on different schedules and may use different forms of communication. For example, elementary school teachers are often in classrooms where there are computers in a lounge for shared use, but email correspondences are challenging.

9. Details of support material / course work / assessment methods

Student work in this class was broken into three key segments: (1) the design, research, analysis, and final product for the group project (600 out of 1000 points); (2) participation in and facilitation of class discussions during seminar (150 out of 1000); and (3) development of a thesis proposal for original environmental research of appropriate scale and size that is justified in context with existing research.

Describing the assessment of the research project was difficult at the semester outset, when the project had not yet been refined and students did not know exactly what their work would entail. The students understood at the outset that I would evaluate the end product (the community presentation and poster, and a written document) as a key part of the group project. I also explained that they would be evaluated on other additional components as we progressed. All students were expected to contribute to project design, attend outreach events, and summarize events and activities. Moreover, each student had a set of specific project goals that they had to complete that were determined throughout the semester. For example, one student conducted an evaluation of best practices among outreach programs, while another student was the primary contact for developing and submitting the IRB forms. Because this part of the research is determined as we progress, I encouraged students to select topics and small projects that were of interest and matched their schedules, and I was accommodating to these challenges. However, students who want to know exactly when each assignment is due at the semester outset, and the exact format of each assignment in advance, struggle most in this class. Many students have been trained in this traditional way, but are enthusiastic to learn how to think more adaptively and to synthesize more comprehensively as the research progresses in an environment that more closely simulates a professional setting than a traditional classroom. In order to fully evaluate their performance on this group effort, I had each student prepare a portfolio of their work for the group project, submit a self-evaluation, and a group evaluation, which included an assessment of their own work in context to their peers.

10. What leadership issues have arisen?

Faculty who excel in integrating their research into teaching and who are able to provide rich experiences for their students in research do gain a great deal. They are able to explore areas of their research that perhaps would not have been explored but for a class project, they spend less of their time divided between their research and their teaching—the two are less in conflict and their brains forced to switch gears less frequently or less dramatically. However, there are costs to such efforts as well—the amount of time expended on the undergraduate experience may not “pay off” in all institutions, depending on the tenure and promotion process. This will require faculty leadership, administrative leadership, and particular skills at explaining the process in those institutions where the leadership is less aggressive at advancing undergraduate research.

I have found that there are also challenges to the integration of research and teaching. In the professional development of a portfolio, it is difficult to separate effectively certain activities into the research or teaching category. Rather, these activities fall under both headings and need to be discussed in promotion and tenure settings under both categories as well. This often takes skill to ensure that the faculty can explain various aspects of the project that serve multiple

purposes, and that the faculty does not short-shrift their activities by categorizing them exclusively.

Students, faculty and administrators alike are often scared of research, scared of getting involved in the community, and are not sure the two can coincide—even at institutions with a strong commitment to undergraduate research, administrators may not have ever been in the position of conducting and completing the work to understand the significant pitfalls and challenges. Students, faculty and administrators alike need to overcome these fears of operating outside a traditional classroom setting in order to reap the rewards of increased student ownership of the process of research. Good leadership will train administrators to know the expense in time that such efforts take, and will help faculty to conduct such initiatives by funding service-learning directors, offering curricular development grants to faculty to establish contacts, and offering TAs to assist with classes. Students need guidance to learn that gaining research skills is a far greater goal to achieve from their undergraduate education than extensive memorization even in their own disciplinary field. A strong school with clear goals will provide the necessary support to all levels in the academy to make these leaps of courage in the classroom possible.

11. Are there significant resource issues / implications?

The biggest issue is student time put into the project. This class structure will start off organized somewhat like a traditional class, but it is hard for students to be able to prepare for the time it takes to conduct research, particularly as a team. Many of the skills that they are learning (networking, problem solving, group process, time management, organization) are often not typical skills that they have mastered (critical reading, analysis, test-taking).

Identifying a topic that really works for your personal goals will greatly affect the sustainability of this model. So topic identification is essential—but not easy. After teaching this course one semester a few years ago on a topic that was tangentially related to my research, I realized that the course did not advance my own research, nor did it provide a template for a topic that was replicable. I decided to try engaging the students in this course to help pilot studies to explore aspects of my research, in that instance evaluating indoor air quality of homes as a means to prioritize environmental health risks to children. In this manner, the students would gain an honest perspective on research that could potentially be incorporated into the community-based Healthy Homes-Healthy Children program. Both the students and I gain in this model—for example, I found in that previous semester that indoor air testing for volatile organic compounds (VOCs) is too challenging, while testing a home for mold is straightforward and valuable. We have incorporated mold-testing into the HHHC free home assessment program.

However, through these pilot assessments, I was able to identify a topic that can be replicated in future semesters. The development and analysis of outreach programming for this initiative can work multiple times in the future. The next time that I offer this course, I can focus on research on outreach efficacy and expansion. We will be able to use many of the readings compiled during this past semester, build off of contacts that we have made through the school districts to continue this research as a foundation for this seminar. Students can learn about the built environment and children's health, while also conducting research that is valuable through outreach efforts in the community-based research program HHHC.

Faculty who are interested in using students to assist piloting new avenues of their research could consider this model, as could those who are hoping to find a topic to use and replicate from semester to semester or year to year, each with an eye to maximizing the efficiency of aligning their teaching and research.

12. Relevant references and websites

Healthy Homes-Healthy Children (HHHC) Website

<http://webpub.allegheny.edu/employee/c/cwaggett/HHHC.html>

Caryl's Website

<http://webpub.allegheny.edu/employee/c/cwaggett/index.html>

Link to Course Syllabus / Final Product and Poster

<http://webpub.allegheny.edu/employee/c/cwaggett/courseprojects.html>

Fig 1 Record of Student Experience, Fall 2007

Overall, students responded very positively to this class, as evidenced by their perception of the overall quality of teaching and how much they learned in the course. However, note the significant differences between areas students gauged positively in ES 588, a class with a significant research component (such as: student perception of active engagement in class, constructive assistance and constructive responses, and respect for students), with those areas students found less effective than in more traditional classes within Allegheny College as a whole (such as: class organization, effective assignments, and work returned in a timely manner, all of which were viewed as weaker than average).

